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Some Effects of Radioactive Fall-out on Animals

BY

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Preface—Nuclear Weapons*

SINCE the atomic bombs were used in 1945 much more powerful nuclear weapons have been developed. The effects of all nuclear weapons are similar, but the range of these effects is greatly increased with the more powerful megaton weapons or "hydrogen" bombs. Blast, heat and radioactivity are the three forms of energy released when a nuclear explosion takes place. The radioactivity may be both immediate and residual, the latter assuming greater importance if the explosion occurs near or on the ground. With airburst bombs residual radioactivity is mainly a problem of world-wide fall-out of relatively small intensity; but with ground-burst hydrogen bombs it becomes a serious hazard from fall-out, which will return to earth at great distances downwind from the explosion, in areas completely unaffected by blast, heat radioactivity, effects of which are briefly set out in the table.

The atomic bomb or nominal bomb has an energy release equivalent of 20,000 tons of T.N.T. A ten megaton bomb is equal to 500 times a nominal bomb. The effects of blast, heat and immediate radioactivity may be briefly tabulated:—

It will be observed that there is an even chance of survival from the effects of immediate radiation up to 2½ miles from ground zero, but this distance is well within the zone of destruction from blast and heat. It would not, therefore, add materially to the number of casualties. The quantity of gamma radiation absorbed in a given time is referred to as a dose, the unit of dose for gamma rays, as for X-rays, being the roentgen (r.), referred to nowadays as the rad. Gamma rays are electromagnetic radiations of nuclear origin emitted from some isotopes during radioactive decay, with a shorter wave-length than light, and usually shorter and more penetrating than X-rays.

The pattern of fall-out from a ground burst will depend to a considerable extent on the winds prevailing at the time of explosion up to the height (80,000 feet) to which the products first ascend. The area affected by fall-out from a ten-megaton bomb

	Radius from ground zero in miles		
	Nominal air	10 megaton air	10 megaton ground
1. Effect on average house :			
Total destruction	½	4	3½
Irreparable damage	¾	6	5
Moderate to severe damage	2	16	13
Light damage	3	24	20
2. Heat Effects			
(*a*) on people exposed in open			
Lethal burns	½		4
Third degree burns (charring) of exposed skin	1		8
Second degree burns (blistering) of exposed skin	1½–2		12–16
First degree burns (reddening) of exposed skin	2½		20
(*b*) Fire. Main fire zone	½–1¼		4–10
Limit of fires	2		16
3. Immediate Gamma Radiation Effects of persons exposed in the open			
50 per cent. chance of survival	¾		2½
No appreciable risk	1½		4

* For fuller information on this subject the reader is referred to Home Office Manual of Civil Defence, vol. 1, part 1, "Nuclear Weapons," published by H.M. Stationery Office.

would probably be of such dimensions as rarely to develop its full extent over the land surface of Great Britain. Radioactivity might be detected upwind to a distance of 20 miles and downwind as far as 1,000 miles from ground zero over an area which at its widest part might be 80 to 100 miles across, but it will mainly contaminate a cigar-shaped area extending to 450 to 600 miles long and 35 to 50 miles wide. In the inner zone of this area which might extend to 70 to 100 miles from ground zero and up to 12 miles wide, the dose of gamma radiation would be 1,000 r. at 1 hour, and would be lethal to every living creature exposed in the open for 36 hours. In the surrounding zone up to 200 miles and up to 20 miles wide the dose would be 300 r. to 1,000 r. at 1 hour and would be lethal to 50 per cent. exposed for 36 hours. Around this zone an area extending up to 450 to 600 miles and 35 to 40 miles wide the dose rate would be 30 to 300 r. per hour at 1 hour and lethal to 5 to 10 per cent. Beyond this zone, there will be an area covering the fringes of the fall-out area in which the dose rate at 1 hour would be up to 30 r. At greater distances there may still be some agricultural hazard.

Seventy-five per cent. of radioactive material returns to earth as fall-out and would constitute a serious civil defence problem for 100 days.

The life-time dose of radiation must not exceed 200 r. acquired in a period of not less than 2 years. The normal limit for occupational workers is 0.3 r. per week but in an emergency up to 25 r. might be accepted if spread over a few hours and slightly higher doses if spread over a longer period.

Nuclear Radiations†

When a nuclear explosion occurs an immense amount of energy is released producing a rapidly expanding white-hot ball of gas at temperatures approaching that in the sun, from which immediate nuclear radiation is emitted in all directions to an extent depending on the power of the weapon. As the fireball expands and cools, there is a blast wave. And as it cools still further, it rises rapidly to a height of many thousands of feet as a cloud, and with the immense suction created draws moisture and dust from the atmosphere or the ground which mix with the products of the explosion. When the explosion is at ground level, the fireball vaporises large quantities of matter from the surface which later cool and condense into a range of particles some of which will be very fine. Ground level explosions contain much more solid matter than explosions in the air. Eventually, the radioactive particles in the cloud fall to the earth, the heavier particles naturally falling first and the lighter particles later, as "fall-out," and continue to emit radiation which is called residual radiation. It is about the effects on animals of this residual radiation that I have been asked to write. I propose to concern myself mostly with the lighter material which is carried higher and deposited further downwind beyond the area devastated by heat, blast and immediate radiation effects.

Fortunately while this radioactive material is drifting downwind it is decaying all the time. The activity is reduced by a factor of 10 when the time is multiplied by a factor of 7, so if, for example, the dose rate 1 hour after explosion was 100 r. per hour, then at 7 hours it would be 10, and at 2 days 1 and at 2 weeks only 0.1.

Nuclear radiations consist of alpha, beta and gamma rays and neutrons. Alpha rays lose all their energy in passing through only a few inches of air by collision with other atoms, cannot penetrate the skin and may be disregarded as an external hazard. Neutrons are very penetrating uncharged particles emitted during the first few seconds after an explosion, which travel outwards therefrom at great speed and reach the ground almost at once. The delayed danger from residual nuclear radiation or fall-out is concerned externally with the effects of beta and gamma radiation, and internally chiefly with the beta particles and occasionally with alpha particles.

The effects of the various types of radiation depend on the power of penetration and on the number of electrically charged atoms and molecules, known as ions, left in their tracks through tissues. These ions are mainly responsible for the physico-chemical changes which take place in living tissues, and these biological effects are dependent on the intensity and duration of the dose.

The action on living tissues of ionising radiation is not properly understood, but it is generally thought that radiation acts upon the cell and its constituents and upon the complicated chemical processes which occur in them. It is probable that, following the physical process of ionisation, highly reactive intermediate chemical substances are liberated.

All living tissue can be killed if exposed to sufficiently high doses of radiation, and the effects of ionising radiation on tissues is essentially deleterious. Radioactive elements emitting rays cause intense ionisation in their immediate neighbourhood leading to death of tissue or to neoplasia.

Beta rays have a short range in the air, and it is only when radioactive material is on the ground a few yards in radius from where an animal is standing that these rays will be effective, or when fall-out has direct contact with the skin. Beta particles produce a burning effect on the skin similar to sunburn, with erythema and exfoliation of the epidermis. The erythematous reaction occurs in 24 to 48 hours, then fades, and may reappear 10 to 28 days later. In the severest form of beta burn there may be necrosis of the epidermis.

Externally, besides beta rays, gamma rays may have serious effects. These rays have great penetrating power and the more energetic gamma rays can traverse the whole body with very little absorption. Consequently, the whole thickness of the animal body may become irradiated by gamma radiation and this accounts to a large extent for the general illnesses which follow this type of radiation.

An animal may be seriously affected by external radiation without becoming contaminated. Whole

† For fuller information on this subject the reader is referred to the Medical Research Council Report, "The Hazards to Man of Nuclear and Allied Radiations," Cmd. 9780, H.M.S.O., and Home Office Manual of Civil Defence, vol. I, part 1.

body irradiation with large doses in a short space of time will produce severe and possibly fatal illness within a few hours, certainly within a few weeks.

In zones nearest to the heaviest deposits of fall-out animals remaining in the open for 36 hours will receive lethal doses of gamma radiation. Doses of the order of 500 r. will produce the radiation syndrome and such doses would be accepted by animals left continuously in the open at distances of 200 to 300 miles from the point of burst.

Varying Effects of Radiation

In dogs, as in man, this will take the form of "radiation sickness." There will be nausea and vomiting due to gastro-enteritis. with profound lethargy and anorexia. After a short period, from hours up to a few days, the animal will return to normal with good appetite. Gradually leucopaenia develops, which may be followed by septicaemia or haemorrhage (Loutit & Russell, 1955).

Cronkite (1949) refers to a study of goats exposed to radiation from nuclear detonations, and states that those exposed to the highest doses of gamma radiation remained quite active for 2 to 3 days. Hyperaesthesia was noticed, which increased up to the third day. This was followed by periodic diarrhoea, loss of appetite and apathy, persisting until death which occurred 3 to 5 days after the explosion.

Goats receiving smaller doses were found to be slower in developing symptoms. In 3 to 7 days they showed diarrhoea, rhinitis, petechiae, epilation, anorexia and apathy until death in 9 to 15 days. The haematological changes due to irradiation will be discussed later, but it was found that once there was a rapid decrease in leucocytes death usually occurred within 6 days. The occurrence of diarrhoea on the second or third day was regarded as an unfavourable sign.

Trum and others (1952) found that in burros the response to exposure to large doses of gamma radiation to the whole body depended on the amount or total dose and the rate at which it was applied. Doses from 225 r., which is non-fatal, to 1,230 r., which is fatal in every case, have been recorded. During exposure and 24 hours afterwards, the asses appeared normal. On the second day apathy and malaise were noticed, and a few died with encephalitic symptoms. Most of them continued dull but restless, with moderate disinclination to feed for 5 to 7 days when the appetite was gradually restored, although the higher the dose the more slowly did the appetite return. By the second and third week anorexia reappeared. From the second day, a disinclination to bear weight on the legs was observed. The animals showed a frequent desire to lie down, or to rest each leg in succession. A few were noticed to walk jerkily, as if affected with stringhalt. Encephalitic symptoms included a forward pressing behaviour during which the animal pressed its head against a fence or manger for considerable periods of time and until turned in another direction.

No regular changes in pulse, respiration or temperature were noted, but when the animals were comatose or semi-comatose the respirations were observed to be slow and shallow. Venous pulsation was often observed, and with a few exceptions temperatures remained normal until a short period prior to death. Dyspnoea was commonly found and this was due to partial occlusion of the upper respiratory passages from facial and guttural oedema.

There was no epilation even with the greatest doses. Hyperaesthesia of the skin occurred for a few days, but this was soon lost. There was an oedematous thickening of the skin of the face in many animals which died. Later, the skin was covered with an oozing exudate which became encrusted. Tumours and scars of the skin exuded and became bleeding sores. Wounds, although contaminated, did not suppurate. When bleeding became profuse, death occurred within a few days. Some began to heal after 4 weeks.

A severe conjunctivitis was observed in some animals between 2 to 7 days and between 14 to 18 days. Various degrees of vascularisation of the cornea and leucoma occurred. Haemorrhages in the retina were also observed.

Blood-tinged mucus was seen around the anus after the ninth day, but diarrhoea was only occasionally present. *Post-mortem* examination showed haemorrhoids, ecchymoses and petechial haemorrhages in the gastro-intestinal tract.

Non-pregnant females were in oestrus for most of the post-irradiation period up to 30 days. All females which died showed enlarged polycystic or monocystic ovaries which were frequently blood-filled. Males showed retraction of the testicles within a few days. The testicles were carried high or within the inguinal canal for a few weeks. The animals were, however, not observed prior to irradiation. There was a reduction in size and weight of the testicles. There was no clinical evidence of any damage to the kidneys.

Blood Changes

Blood changes were spectacular. Almost immediately there was a fall in lymphocytes, and these had practically disappeared in the peripheral circulation at the end of 48 hours. There was a progressive reduction in other blood cells until 4 weeks when some signs of recovery were observed in some animals. White cells dropped from 16,000 per ml. to as low as 500, and red cells from 11,000,000 per ml. to 1,000,000. Death usually ensued at these levels. Haematomas occurred under the skin at the site of puncturing the vein. The clotting time lengthened from 9 minutes to 30 minutes, and blood clotted *in vitro* did not retract normally from 8 to 30 days; this corresponded with the disappearance of platelets from the circulating blood. Petechial haemorrhages under the mucous membranes were most noticeable in the lips and vagina.

After 14 days death followed severe haemorrhage, usually by bleeding internally through the spontaneous rupture of some organ or blood vessel. Deaths occurred within 45 days.

XUM

The nervous symptoms observed consisted of partial paralysis of the tongue and inability to swallow in 25 of the 133 burros, ataxia in 12, forward pressing in 12, sudden collapse in 6, spasmodic hock flexion in 5, paralysis of the ears in 3, jerking of the head in 2, and twitching of the tail in one. Between 2 and 6 days, some animals collapsed suddenly and died after encephalitic symptoms.

Some 77 burros, survivors and controls from experiments carried out are being kept under observation for long-term effects, but it is too early for these to be correlated.

Sublethal doses of gamma radiation may produce mild forms of radiation sickness and a fall in the number of cells in the blood. In addition they will lower resistance to infection, due to the conspicuous absence of inflammation in irradiated animals. Ionising radiation reduces or abolishes active or passive immunity to bacterial infections. This is dependent on the dose received, and significant changes do not occur unless the dose exceeds 200 r. Up to 10 days there is an adequate reserve of antibodies, but some 10 to 14 days after exposure bacteraemias may develop accompanied by severe generalised illness.

Cell Sensitivity

There is considerable variation in cell sensitivity (Rust, 1951). The tissues in order of sensitivity are lymphocytes, granulocytes, epithelial cells (glandular epithelium being more sensitive than surface epithelium), endothelial cells, connective tissue, muscle, bone and nerve. Cells about to divide are often more sensitive than those at rest.

In the lungs will be found degeneration of the lymphatic glands, increased secretion of the bronchial mucous glands with congestion and leucocytic infiltration. Later, there is degeneration of the bronchial epithelium and adjacent tissues with peribronchial and perivascular infiltration. Lung tumours have been found in mice following prolonged gamma irradiation.

The gastro-intestinal tract is very sensitive both to external and internal irradiation. The damage is in proportion to the dose. The epithelial cells become swollen and vacuolated, have prominent nuclei, and cytolysis may occur. Glandular epithelium is more sensitive than surface epithelium. The lymphatic glands show early damage. Oedema may occur with moderate doses. With heavier doses there is destruction of the epithelial lining with ulceration. Haemorrhage, congestion and leucocyte infiltration occur within a week and reach the peak in about 2 months. Mucus secretion is increased even with sublethal doses.

The pancreas is resistant; so is the liver, but heavy doses will disturb the functions of these organs. The salivary glands are moderately sensitive.

So far there have been no reports of damage to the kidneys, but there is some doubt whether there is no damage to renal epithelium by radioactive material which is normally eliminated by the kidneys. The bladder shows inflammation and ulceration.

The interstitial cells of the testicles are very resistant, and the cells of Sertoli are not altered. The spermatogonia are the most sensitive of the spermatogenic cells. Aspermatogenesis results from the cumulative effects of very low daily dosage.

There are no changes in the ovaries for the first 48 hours, when clumping of the chromatin of most ova occurs. In 6 days, no normal ova can be seen and many are degenerating. In 10 to 11 days, a few primitive ova, and young developing follicles may be found, while degenerating follicles are present in abundance. By 22 days, the nuclei of many ova which had moderately increased were hyperchromatic, and paired ova were numerous. The ovarian stroma was dense. Ovarian tumours may occur.

As far as the vascular system is concerned the heart muscle is very resistant to radioactivity. The blood vessels, however, show changes mainly in the endothelium but no cells escape injury.

As has already been mentioned the skin is chiefly concerned with beta irradiation, resulting in an erythematous reaction in 24 to 48 hours which then fades and reappears 10 to 28 days later. Heavy doses of gamma rays may produce oedema of the skin and exudative dermatitis. Loss of hair may occur, the hair follicles being quite sensitive, especially the superficial ones. The sweat and sebaceous glands are also sensitive.

Bone is generally considered to be comparatively insensitive to ionising radiations. The extent of damage depends on the dosage and age of the bone. The growth of immature bone may be halted or retarded. It is, however, particularly sensitive to ingested radioactive heavy elements.

In bones the haematopoietic cells are destroyed; first, the erythroblasts, secondly the myelocytes and thirdly the megakaryocytes. Macrophages, reticular cells and fat cells are resistant. Dilated sinuses and fatty gelatinous marrow replace the haematopoietic cells. The damage is in proportion to the dose of radiation, and if not too great regeneration will occur. The bone marrow at the growing ends of the bone is more sensitive to roentgen rays. With ingested radioactive heavy elements such as radium, plutonium and strontium, these are deposited in and about the marrow. Repair begins in the shaft, then in the epiphysis, and finally in the metaphysis. Prolonged exposure produces a typical fibrous bone and tumours may form.

Both the central nervous system and nerves are very resistant to radiation but large doses cause damage of a haemorrhagic or necrotic nature.

Genetic Effects of Radiation

We have seen that sperm and ova production is halted following radiation. It is not resumed for several weeks. Males which have been irradiated within lethal range show interest in females in oestrus until just before death. Spermatozoa may survive in the epididymis for several days.

Several generations must be observed before a change in the mutation rate can be detected. Irradiated males or females should be used with caution.

Irradiation of the embryo may result in cessation of development or growth of a particular organ or system.

There are few published works on the changes in reproductive efficiency in the domesticated animals. The following relevant items have been recorded by Trum in a private communication (1955).

After 4 years, a group of 60 female burros, survivors of lethal dose experiments (300 r. to 530 r.) of whole body irradiation were found to have normal oestrous cycles.

Experiments with mice have shown that irradiation during the period of preimplantation (0 to 5 days) produces a high incidence of foetal deaths, but those that survive are normal. During the period of major organogenesis (5 to 13 days) it results in a high rate of prenatal and neonatal deaths and a peak of gross abnormalities. Applied during the period of the foetus (13 to 20 days) it results in less grossly apparent effects at birth, but causes a number of delayed effects.

Fifteen Hereford cattle, pregnant for 28 to 45 days were irradiated with 300 r. total body gamma radiation, and no embryonic aberrations occurred. This may have been due to the dose being inadequate or to the time of application being unfavourable.

Preliminary studies on the semen of bulls exposed to 400 r. total body gamma radiation showed an increase in abnormal morphology during the 6th week after exposure, 5 per cent. aspermia at 18 weeks and recovery after 20 weeks.

Trum does not consider the problem of fertility in domestic animals by exposure to ionising radiation to be serious, as acute doses, large enough to cause fertility impairment, will seriously affect all animal life to a far greater extent in other ways.

Mutations due to radiation cannot be distinguished from naturally occurring genetic changes. Large numbers of animals would have to be observed for many generations to detect any increase. On account of selective breeding for the improvement of livestock, there is not the same risk as in man.

Treatment

Rust *et al.* (1950) studied a number of compounds with a view to prolonging the survival of mice exposed to acute whole body X-radiation. None was of great value in doing so where the mice were exposed to single acute doses. The administration of glutathione before irradiation proved effective at 500 r.

There is no therapy which will reduce mortality in animals.

Valuable animals might benefit from the administration of antibiotics, if exposed only to moderate levels of radioactivity, but salvage for food is better that treatment. The aim should be the protection of animals against fall-out by placing them under cover if possible until the level of radioactivity is safe. Doses up to 300 r. total body irradiation can be tolerated, but when this amount is exceeded some deaths will occur. To estimate the integrated dose in infinite time from the time measurement is made, the formula F x I x T can be used where F=factor 5, I=the dose rate at the time of entrance into the field and T=the time since the detonation. Thus an animal placed in a field (where the radioactivity is 1.5 r. per h.) 5 hours after detonation would receive 37.5 r. if it remained there for ever. Animals should be confined to small areas of pasture, and be given a supplement of uncontaminated feeding-stuffs.

Food Animals

Wasserman and Trum (1955) fed meat from lethally irradiated cattle (6,000 to 7,000 r.) destroyed *in extremis*, and sheep dying from exposure to 3,600 to 5,280 r., to beagles and greyhounds. There was no significant difference in daily weight gains, nor in blood cells or composition, between experimental animals and controls. *Post-mortem* examination revealed no pathological changes. The finding that flesh from lethally irradiated animals was not injurious was confirmed in albino rats and chicks.

The flesh of animals, if slaughtered 2 to 3 days after exposure to external irradiation, or which have recovered from ensuing illness, can be safely used as meat. Animals which have consumed feeding-stuffs contaminated by radioactive fall-out should be bled and boned. The blood, bones and offals of such animals should be discarded.

The main hazards to grazing animals are external radiation and radioactive poisoning. The latter follows the introduction of radioactive materials into the body, by inhalation of contaminated dust, by ingestion of contaminated food or water, and by gaining access to the blood stream through injuries to the skin. The most important of these in grazing animals is that of ingestion, for besides the effects of irradiation of the alimentary tract, there is an additional hazard through the metabolic absorption of some of the long, half-life fission products, especially iodine and strontium. Herbivorous animals in a fall-out area, owing to their mode of feeding on the tops of herbage, would take in large quantities of fission products. Ruminants, in particular, owing to their complicated digestive organs, and the very considerable time that ingesta take to pass through the alimentary tract, are probably the worst affected through irradiation.

It has been estimated that about 10 per cent. of deposited fission products will be soluble, and when soluble radio iodine and radio strontium are ingested by dairy cows, they are excreted in the milk. Soluble strontium, too, may be retained in the soil to be absorbed later by growing plants in which it is found particularly in the foliage, and not to any extent in the seeds.

The absorption of radio iodine is virtually 100 per cent., and much of it will be excreted in the urine; but about 20 per cent. will be found in the thyroid and a small percentage will be excreted in milk.

Strontium 90 has a very long half-life—20 years—and like calcium is deposited in bone where it remains. In fall-out its yield may be as high as 4 to 5 per cent.

When these radioactive isotopes are deposited in the animal system, they will exert their influence from the sites where they settle down. Internal effects are similar to those of penetrating gamma radiation. As previously mentioned the effects will be dependent on dose, depth of penetration, and the rate of application of dose.

XUM

Russell and others (1956) have recently calculated that there is a hazard to grazing cattle from pasture which is contaminated at very low levels. As it takes about 50 hours for 80 per cent. of the contents of the rumen to pass through the rumen and reticulum, these are the parts of the alimentary tract which will be most seriously affected. The extent of the damage to the organs will depend on the age of the fission products consumed and on their solubility. The lower the solubility the greater the hazard to the gastro-intestinal tract.

The same authors conclude that the hazard to external radiation will be negligible compared with the hazard from the metabolical absorption of fission products, if these products are deposited in a soluble form and grazing cattle consume 30 lb. of herbage daily. They stress, however, that it would be imprudent to dismiss the importance of protecting cattle against direct exposure during the initial period.

Milk will be safe for feeding to young animals when the deposition is 30 times greater than that which gives rise to a hazard to infants or to the animals themselves.

In mice, Gorbman (1950) found that high radiotoxic doses of iodine resulted in curtailment of growth, failure of functional and regenerative properties in the thyroid, parathyroid injury, tracheal injury, and tumours, recurrent nerve injury, ovarian sterilisation, and fatal adenohypophyseal tumours. Later the same worker found that under certain circumstances 200 microcuries or more of iodine 131 caused complete thyroidal destruction in mice, and doses of 100 microcuries permit survival of small portions of atypical thyroid tissues, which even after 400 days show no tendency towards regeneration.

When iodine 131 was chronically administered to sheep at the rate of 5 microcuries per day, Busted *et al.* (1952) demonstrated a decline in thyroid function. Lambs from ewes fed with radioactive iodine exhibited damage at birth.

Radio-strontium is a bone seeker, and the damage it will cause will principally be found in bones, at the epiphyseal plate, beneath the periosteum, and in the bone marrow. In the two former sites, the effect is delayed even up to many years, and will usually be demonstrated only as long-delayed osteosarcomas. The effects on the bone marrow are rapid. Strontium also is secreted in milk.

Experiments to determine the metabolism of strontium in rabbits (Tutt & Vaughan, 1949) by the intravenous injection of Sr 89 and Sr 90 as the chloride in a salt solution demonstrated that most of it was detained in bone and that the retention varied with age from 10 to 55 per cent., the skeletal uptake being greater and much more rapid in the young. Suckling mothers transferred about 20 per cent. to the litters, but pregnant mothers transferred only 1 to 3 per cent.

In experiments by other workers bone tumours were obtained in mice which received weekly doses of 1.5 or 2.1 microcuries of calcium 45 with strontium 89 for 6 months.

(*Concluded at foot of col. 2, page* 686)

Surgical Closure of the Cleft Palate

BY

GORDON KNIGHT

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CONGENITAL cleft palate in dogs is not a common abnormality, but its occurrence is more likely to be seen in the short headed breeds associated with hare lip than in long headed breeds. The defect results from a closure failure of the parts of those bones which together form the hard plate, *i.e.*, the palatine, maxilla and premaxilla.

Cleft palate, depending on its extent, allows direct communication between the mouth and nasal chamber, thus an affected puppy's inability to suck normally is usually in relation to the cleft. Some breeders of achondroplastic varieties of dogs examine the palate of a puppy soon after birth and have it destroyed if a serious cleft is present. Therefore, for one reason and another, extensive cleft palate is seldom found in mature or nearly mature dogs. In the writer's experience this is certainly true of the intermediate and long headed breeds.

This report concerns a normally developed Golden Retriever dog puppy aged 7 months with a history of frequent sneezing attacks, the onset of

FIG. 1

which came shortly after purchase at 3 months. Later, fluid was often regurgitated through the nose. Examination of the mouth showed, except for a short mucosal isthmus, a complete median cleft extending from about the level of the canine teeth's anterior border (Fig. 1). By comparison, the cleft was unusually long, but in view of the animal's good development it was decided an attempt should be made to repair the defect.

The operation was carried out in two stages, firstly on the anterior part of the fissure and secondly on the posterior soft palate cleft.

The first stage comprised the release of the soft palatine tissue by incision along each side medially and closely adjoining the teeth from about the level of the corner incisors and the first molars. The tissues were then lifted away from the underlying bony palate by blunt dissection until each side could be drawn medially and made very slightly to overlap. The overlapped margins were then excised, leaving cut borders which it was hoped would heal after co-aptation by sutures. This was done by using interrupted monofilament nylon supported by 3 braided stainless steel mattress sutures. In 3 weeks the wound had healed as seen in (Fig. 2).

The second operation was then carried out on the soft palate cleft immediately following the removal of sutures from the first operation site. The soft palate cleft was treated in the same way as the hard palate cleft, *i.e.*, by excision of a fine strip of tissue from the margins and sutured with interrupted monofilament nylon. Supporting mattress sutures were not necessary as the tension was much less in this area. After a week this part of the cleft had united and the sutures were removed. Fig. 3 shows the healed palate a week later.

The operations resulted in suppression of the symptoms and could therefore be regarded as successful. Unfortunately a few months later the animal developed a neurotropic virus infection and had to be destroyed.

Acknowledgment.—Grateful acknowledgment is made to Mr. A. Goddard, B.SC., M.R.C.V.S., who referred the case to the Royal Veterinary College.

Reference

MUNSON, T. O. (1957). "Canine Surgery." American Vet. Pub. Inc.

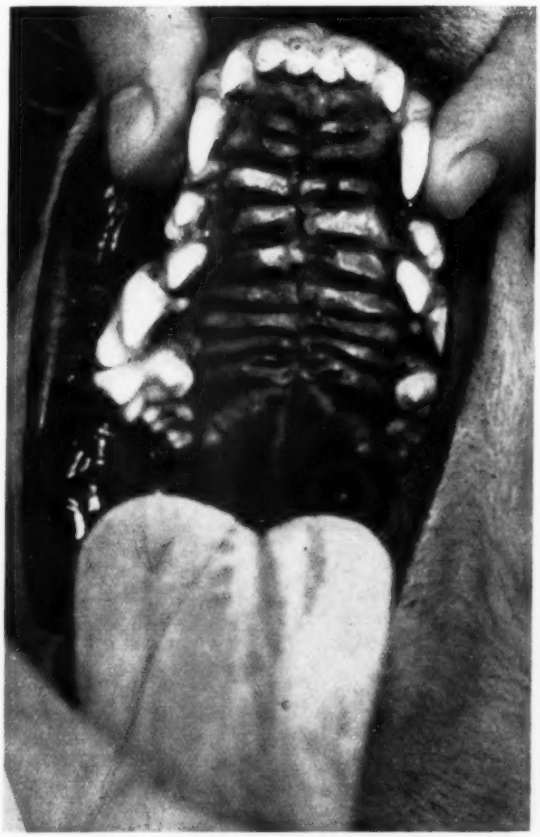

FIG. 2

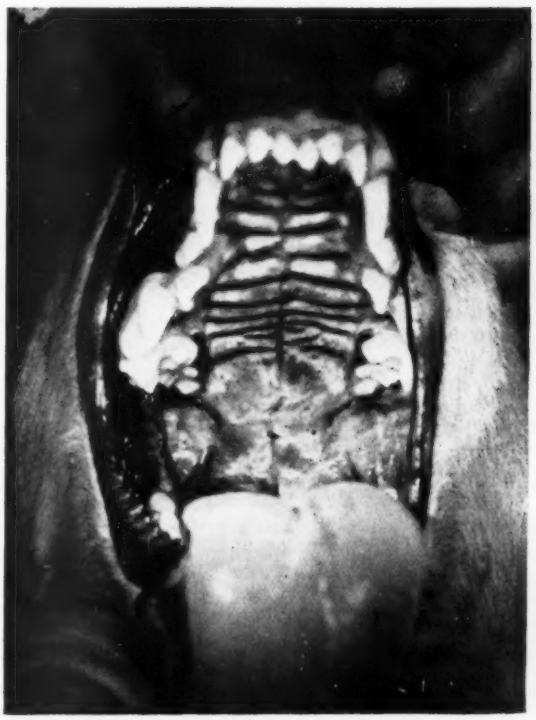

FIG. 3

An Analysis of the Reproductive Function of Mares Based on *Post-mortem* Examination

BY

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IN the last two decades a voluminous literature has appeared on reproductive disorders of cattle; it comprises data from *post-mortem* examinations as well as clinical observations. In a food-producing species it is a simple matter to maintain a logical approach to breeding problems by constant reference to abattoir material. Hitherto, owing to a paucity of equine slaughterhouse material, it has been difficult to obtain information on horse breeding based on *post-mortem* findings. However, during the war years and immediately afterwards, due to food shortage and to the mechanisation of agriculture, there developed a considerable trade in horse-flesh. Thus there became available a substantial source of *post-mortem* material on which studies of equine reproduction could be made.

Materials and Methods

A large proportion of the horses killed for meat were slaughtered in London and, from May, 1949, to January, 1951, through the good offices of Mr. H. E. Bywater, M.R.C.V.S., regular, as far as possible, monthly collections of genital organs were forthcoming. The animals were representative of the equine species and ranged from heavy draught mares to forest and moorland ponies. In the slaughterhouses the genital tract, comprising both ovaries, uterus, cervix and most of the vagina were excised and immediately placed in a milk-churn containing 10 per cent. formalin. After transportation to the College Field Station, the tubular part of the genital tract was examined and notes made on macroscopic features, namely size of cornua, consistency of uterine wall, appearance of the cervix, and, after incision, on the nature of the uterine content, if any, and the appearance of the endometrium. The ovaries, together with a short portion of each uterine horn and oviduct, were then clamped together with an identifying tag and stored in 10 per cent. formalin, the remainder of the specimens being discarded. Subsequently, partly during tutorial classes, batches of ovaries were examined in detail. The dimensions of each ovary were recorded and, after making serial sagittal sections at half-centimetre intervals through these organs, their contents were noted. The number of follicles over 0.5 cm. diameter was recorded and the size of the largest observed. All corpora lutea of the current or preceding generation were described with reference to size, shape, colour and consistency Parovarian cysts of the epöophoron, fimbriae and mesosalpinx were also recorded, as well as any abnormalities of the ovarian adnexa and oviducts.

A total of 792 specimens were examined and the data assembled.

Results

The size of the ovaries

The size of the ovary was determined largely by the number and size of the follicles present (Figs. 1, 2, 3, 4). It will be appreciated that one or two follicles of from 4 to 7 cm. will cause a substantial ovarian enlargement. Such follicles were usually found in association with a regressing, quite yellow corpus luteum and in addition to the one or two large follicles, each ovary commonly contained from 6 to 9 smaller follicles of variable size. These large specimens were regarded as indicative of oestrus. On other occasions very large ovaries were found to contain many medium-sized follicles of 1 to 3 cm. in the absence of a current or recently regressing corpus luteum. They were more commonly found in winter and were presumed to be from anoestrous mares. The smallest ovaries contained the fewest and smallest follicles, but whereas some were clearly anoestrous specimens, others were obviously of dioestrus because of the presence of a current corpus luteum. Equally small ovaries were also found at the end of pregnancy. The largest ovary was from a mare pregnant with a foetus of 18.75 cm. (Fig. 4). Quite commonly, there was gross disparity between a pair of ovaries, particularly when the one organ contained a large follicle(s) of 4 to 7 cm. and the other showed medium or small follicles and a regressing corpus luteum. This illustrated the wide range of normal size caused by functional variation.

Whereas the medium to large follicles could be easily palpated, even in the fixed *post-mortem* specimen, it was impossible to determine the content of the non-fluctuating ovary and thus fail to distinguish an anoestrous from a dioestrous specimen.

Factors other than follicles which affected ovarian size were breed (body size), corpora lutea and the development of the epöophoron. The corpus luteum contributes materially to ovarian size especially in its early stages when it refills with blood clot or "secondary liquor." The fully developed corpus luteum of 2 to 3 cm. is well accommodated in the dense ovarian stroma whose consistency it closely resembles.

The epöophoron of the mare is an interesting structure which could confuse a clinician for it is often considerably dilated by fat, or, more substantially, by retention cysts which sometimes assume large size. The largest cysts of the epöophoron—which on rectal examination feels like a part of the ovary—were from 4 to 7 cm. Their contents were watery and not coagulated by formalin as was the *liquor folliculi*. The size of these vestigial cysts

G. H. ARTHUR.—AN ANALYSIS OF THE REPRODUCTIVE FUNCTION OF MARES BASED ON *POST-MORTEM* EXAMINATION

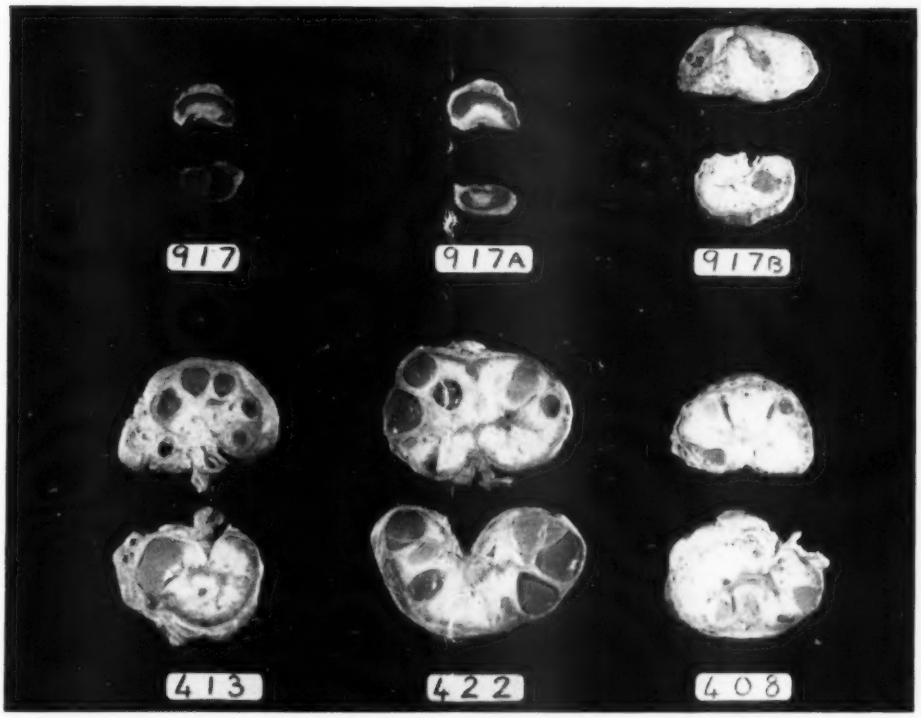

FIG. 1.—SECTIONS OF ANOESTROUS OVARIES.
In each pair the left ovary section is uppermost. 917. Ovaries of a filly.
917A. Ovaries of a case of gonadal hypoplasia.
917B, 413, 422 and 408. Ovaries of variable size depending on breed and follicular content.

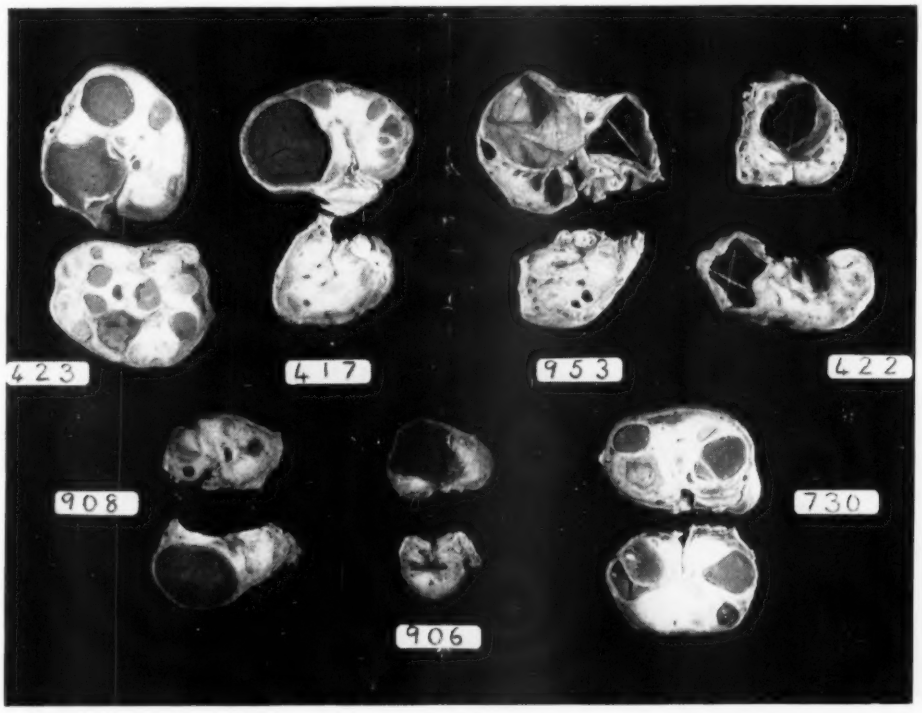

FIG. 2.—SECTIONS OF OESTROUS AND DIOESTROUS OVARIES
423. Ovaries of late dioestrus. 417. Ovaries of early oestrus.
953. Ovaries of late oestrus. 422. Ovaries of recent ovulation.
908, 906, 730. Ovaries of dioestrus showing stages in development of corpus luteum.

XUM

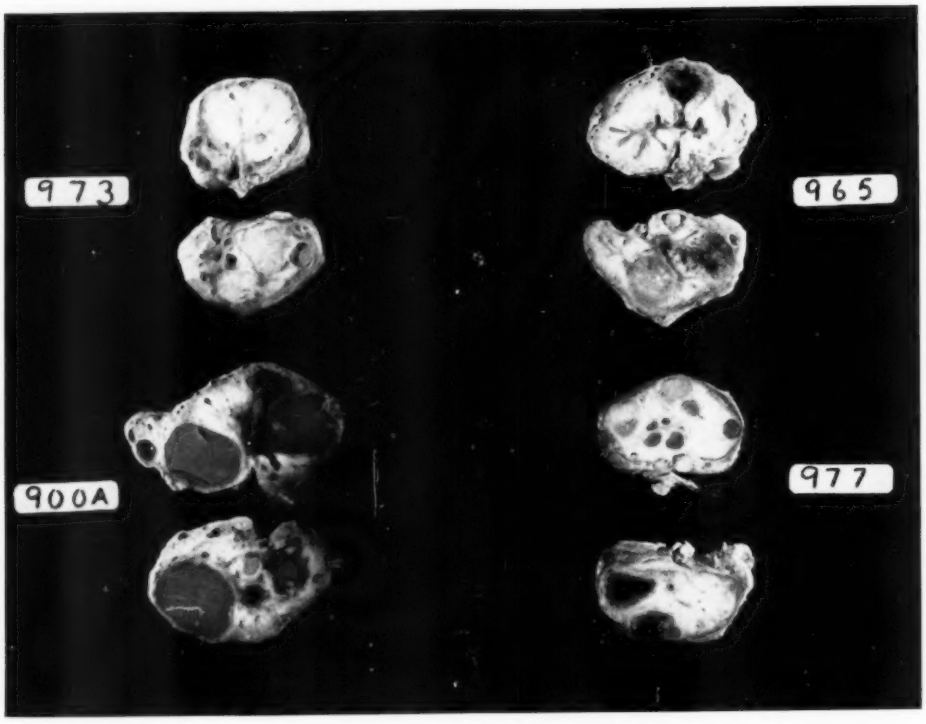

FIG. 3.—SECTIONS OF DIOESTROUS OVARIES WITH TWIN CORPORA LUTEA.
973, 965, 900A. Stages of dioestrus showing one corpus luteum in each ovary.
977. Two Corpora Lutea in right ovary.

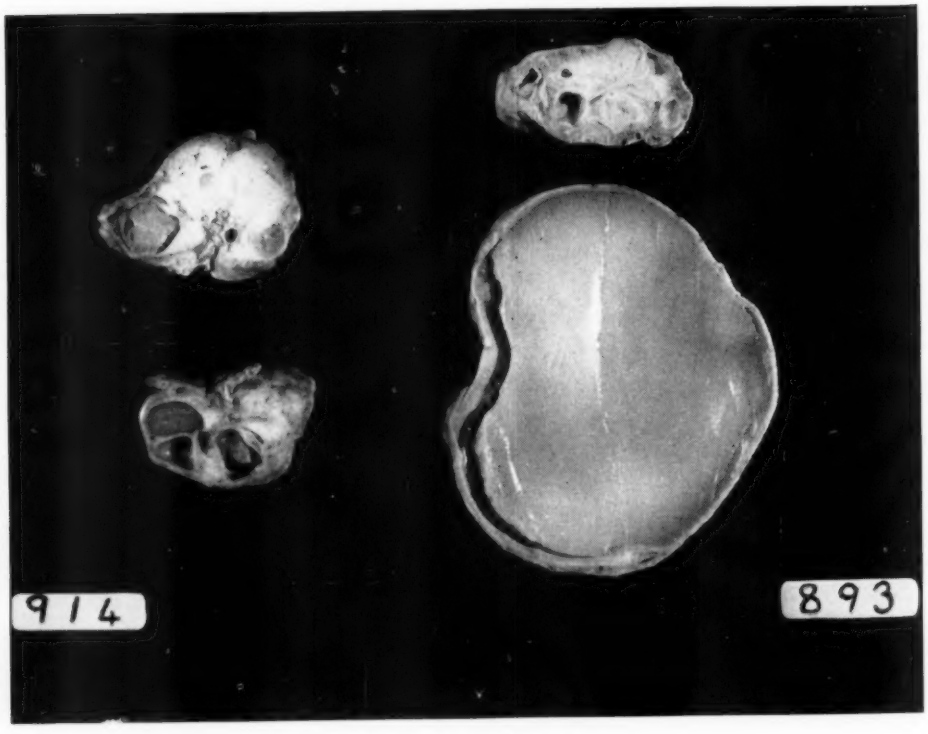

FIG. 4.—OVARIES OF PREGNANCY.
914. Twin corpora lutea in left ovary.
893. Corpus luteum in left ovary. A 10 cm. "cyst" in right ovary (FBL 18.75 cm.).

did not seem to be influenced by season of the year, or by cyclical ovarian activity.

Cysts of the fimbriae and mesosalpinx were common but are not likely to be confused with the ovarian mass on rectal palpation.

From the clinical aspect it may be concluded that a large, fluctuating ovary indicates follicular development (or epöophoron cysts) but that a small ovary does not necessarily indicate inactivity, for, although such ovaries may contain no significant structures, they are equally likely to contain current corpora lutea.

Graafian Follicles

Number of follicles. One of the outstanding features of the equine ovary is its prolific follicle development. Only a small proportion of ovaries were without follicles of diameter 1 cm. They were either very small pre-puberal and hypoplastic specimens, or medium-sized ovaries of true anoestrus seen especially in the January-April season. In many mares without a functioning or regressing corpus luteum, there was marked follicular development—these were presumably animals approaching the breeding season, or alternatively, passing into anoestrus. In mares with corpora lutea the greatest follicle development was seen where a pair of ovaries contained a yellow regressing corpus luteum—ovaries of pro-oestrus or oestrus. In the presence of a fully developed corpus luteum follicle formation was not conspicuous. With a regressing corpus luteum there was often a total of 15 to 20 growing follicles and, since only one or two were destined to ovulate, the presence of a large number of atretic follicles is typical of the post-oestrous phase of the mare.

Size of follicles. In the presence of an obviously regressing corpus luteum the largest follicle was from 3 to 7 cm. Quite often there were two large follicles of about the same size. Not uncommonly, the largest follicle showed evidence of luteinisation before rupture and such follicles felt flaccid, even in the fixed specimen. Although developing follicles were arranged in rows parallel to the periphery, the large follicles extended right across the ovary from periphery to ovulation fossa, where ovulation occurred. In only one case was there evidence that ovulation had taken place from the free convex surface of the ovary. In a number of cases there was a protrusion of the corpus luteum from the ovulation fossa.

The largest follicle seen was of 10 cm. diameter in an ovary from a mare pregnant with an 18.75 foetus. There was a corpus luteum in the opposite ovary (Fig. 4).

Corpora Lutea

The young corpus luteum is like a blood clot. In time the central clot shrinks as the lining of the follicular crater becomes luteinised and takes on a shade of greyish brown. Later in the cycle, as the central mass shrinks further, the luteinised part grows inwards and becomes buff, or pale yellow, and more solid. The shape of the fully formed corpus luteum is commonly triangular, conical or mushroom-like, with the broad part peripherally and the apex abutting on the ovulation fossa and occasionally projecting out from the hilus. Almost without exception, if sufficient serial sagittal sections are made, it will be seen that each corpus luteum impinges on the ovulation fossa. Luteinisation of the mature equine corpus luteum is often incomplete and the structure then comprises a peripheral layer of much folded lutein tissue surrounding a central homogeneous dark brown mass of organised "secondary liquor." Many corpora lutea are of very irregular shape and it is then essential to make multiple sections of the ovary in order to be sure of the identity of the several segments of the same corpus luteum. Despite this precaution, occasionally there was a doubt as to whether the luteal mass represented one or two corpora lutea and in these instances a single corpus luteum was recorded. The regressing corpus luteum appears to shrink rapidly and it is always a definite shade of yellow or orange-yellow. Following the next ovulation, the old corpus luteum becomes more rounded and brown. With subsequent ovarian activity the original corpus luteum becomes deeply embedded and compressed and it appears finally as a mahogany streak radiating out from the ovulation fossa.

From the clinical aspect the corpus luteum of the mare is a disappointing structure. It does not protrude from the ovarian surface, save at the ovulation fossa, where it is masked by the curvature of the ovary and by the adjacent prominent fimbriae of the Fallopian tube. It does not alter the shape of the ovary, and its consistency when fully formed resembles that of the ovarian stroma. Only in the first few days of its existence when it simulates a haematoma, or is represented by an indentable crater, may it be recognised by its distinctive texture on palpation of the ovary. However, on *post-mortem* examination, the corpus luteum is a significant structure; a corpus luteum indicates that an ovulation has occurred in a particular ovary. Thus by a study of the luteal elements important evidence may be obtained as to ovulation activity.

Functional activity of the two ovaries

Aggregate figures were assembled on the incidence of corpora lutea. These showed that there was very little difference in activity between the two ovaries, the total corpora lutea in left and right ovaries in the 792 mares examined being 347 and 318 respectively. This means that 52.2 per cent. of ovulations were from the left ovary (Table I). This observation conflicts with the assertion of Kedrov (1939), who, by *rectal palpation* of 574 mares during 804 cycles, found that ovulation occurred 15 to 20 per cent. more often from the left ovary.

Seasonal Activity

One of the unexpected findings of this study was the not inconsiderable number of corpora lutea found in December-April specimens. In these months figures varied from 21 to 87.5 corpora lutea per 100 mares (Tables I and II). Expressed in another way, this means that in winter from 16 to 63 per cent. of mares may have oestrous cycles (possibly

TABLE I

THE SEASONAL OCCURRENCE OF CORPORA LUTEA IN THE MARE

Year	Month	Number of mares	Total Corpora Lutea: Left ovary	Total Corpora Lutea: Right ovary	CLs per 100 mares	Twin Corpora Lutea: Number of twin CLs	Twin Corpora Lutea: Number of twin CLs per 100 mares
1949	May	48	26	21	97·9	7	14·6
	June	40	34	21	137·5	14+1*	35
	July	51	37	32	135·3	16	31·4
	September	48	28	28	116·7	12	25
	December	48	21	28	102·1	9+1*	18·8
1950	January	59	5	5	17	1	1·7
	February	48	14	13	56·3	8	16·7
	March	43	9	4	30·2	4	9·3
	April	41	10	13	56·1	5	12·2
	May	46	24	24	104·4	8	17·4
	December	55	26	20	83·6	10	18·2
1951	January	24	3	3	25	2	8·3
	February	25	2	6	32	1	4
	March	17	3	3	35·3	1	6
	April	33	5	5	30	2	6
	May	21	11	13	114·3	4	20
	June	20	17	10	135	5+1*	25
	July	27	20	15	129·7	5+2*	18·5
	September	20	16	16	160	7+3*	35
	October	18	6	13	105·6	2	11·1
	November	30	20	12	106·7	8	26·7
	December	30	10	13	76·7	3	10
	Totals	792	347	318			

* = Triplet CLs.

TABLE II

THE SEASONAL OCCURRENCE OF CORPORA LUTEA, 1949—1951, COMBINED RESULTS

	Total CLs per 100 mares	Instances of multiple CLs per 100 mares
January ...	21	5
February ...	44·1	10·3
March ...	32·75	7·6
April	43	9·1
May	105·5	17
June	136·2	33·7
July	132·5	28·7
August	—	—
September ...	138·3	37·5
October ...	105·6	11·1
November ...	106·7	26·7
December ...	87·5	16·3

not all manifest). There was a steep rise in activity from April to May and the greatest degree of function was occurring from June to September but there was only a small reduction in October and November. These data bring the domestic mare more in line with the cow and indicate that it is potentially a polycyclic animal with a reduced, but not negligible, ovarian function in winter.

Twin Corpora Lutea

The most interesting finding from the whole survey was the frequency with which two corpora lutea of the same age occurred together, either in one or a pair of ovaries (Tables I and II). This phenomenon was most common from June to September and, if the few cases of triplet corpora lutea are added, the incidence of multiple ovulation per 100 mares ranged from 33.7 to 37.5 during the summer months. In the majority of instances of twin ovulation one corpus luteum was present in each ovary but there were many cases where both corpora lutea were in the same gonad. Occasionally twin corpora lutea in the same ovary could not be established with certainty and then a single corpus luteum only was recorded. Thus it is felt that the figures presented certainly do not overstate the frequency of twin ovulation. Attention must be drawn to the fact that twin ovulation was not confined to the summer but that it accounted for nearly half the corpora lutea present in the autumn and winter specimens. In other words, having regard to the availability of oestrous mares for service at any time of the year there is, in proportion, an almost constant likelihood of twin ovulation.

The Ovaries of Pregnant Specimens

Only six of 792 specimens were pregnant and of these one (No. 824) was of advanced gestation from which the foetus had been removed but the membranes were still present in the left horn. Both ovaries were of the small anoestrous type with no follicles or corpora lutea in the right ovary and only one follicle of 1 cm. in the left ovary. Of the remaining 5 specimens, 4 were pregnant with a single foetus in the right horn and the other showed twin

foetuses in the left horn; in the latter there were two corpora lutea in the right ovary, thus indicating that dual embryonic migration from right to left had occurred. In 3 of the 4 single pregnancies there were twin corpora lutea and in the fourth the left ovary had been removed in the slaughterhouse. One of the 3 bore a foetus of 32 cm. so its corpora lutea were presumably of the "accessory" type, but the other 2 cases of twin corpora lutea were presumably *corpora lutea vera* for they were associated with small embryos of up to 2.6 cm. foetal body length. In both of these latter uteri, in addition to the single normal embryo, there were particles of degenerating tissue which may have represented resorbing foetuses and in one of these there must have been embryonic migration from left to right.

In the ovaries of all except the late gestational specimen there was follicle development, more particularly in those with embryos of 1.4 to 2.6 cm., but the specimen with a foetus of 18.75 cm. was remarkable in that the left ovary showed a follicle of 10 cm. diameter (Fig. 4).

The ovaries associated with uterine abnormalities

There were 8 instances of uterine abnormality comprising 1 case of pyometra, 1 of generalised cystic hyperplasia of the endometrium, 2 cases of solitary cyst of the endometrium—one of which, with a cyst of 6 cm., strongly resembled a pregnancy —2 cases of mucometra and 2 of pneumometra.

The specimens of pyometra and cystic hyperplasia were associated with apparently persistent corpora lutea—2 in each case; one of the mucometra cases was in an anoestrous specimen, but the remaining uterine abnormalities were present in specimens showing cyclic activity.

It may be noted in passing that the uterus at oestrus is very oedematous and the lumen contains an appreciable volume of mucus.

Parovarian Cysts

Parovarian cysts occurred in 3 sites, namely, the epöophoron, the fimbriae, and mesosalpinx. The blind tubes of the epöophoron were frequently cystic and varied in size up to 7 cm. Their effect on ovarian size and the difficulty of their clinical diagnosis have already been mentioned. Cysts of the fimbriae were quite common and they were frequently of 2 to 3 cm. diameter (Fig. 5). Cysts of the mesosalpinx were less common and smaller.

FIG. 5.—CYST OF THE FIMBRIA IN AN ANOESTROUS OVARY WITH BROWN SUB-VASCULAR ZONE OF INTERSTITIAL TISSUE.

Abnormalities of the Oviduct

Only 2 specimens of hydrosalpinx, both unilateral, were seen. There were no cases of ovaro-bursal adhesions as seen in the cow but fine strands of connective tissue often passed from the ovary to the bursa but did not constrict the oviduct.

In studying the patency of the tubes in fresh unfixed specimens by insufflation of air, it was found that the uterus ruptured before any air passed the utero-tubal junction.

Abnormalities of Cervix and Vagina

No abnormalities of the cervix or vagina were recorded. The vulva was not studied.

Discussion of Results Obtained in Relation to the Fertility of Mares

In 792 specimens, there was strikingly little evidence of either structural or gross infectious disease of the genital organs. This is in keeping with current clinical opinion (Day, 1939) that mare infertility is largely of functional origin and of a temporary nature. In a study of this kind, with its absence of data on sexual behaviour, it is impossible to deal with those important aspects of infertility which are concerned with irregularities of the oestrous cycle. Only 3 conditions can be profitably discussed, namely cystic ovaries, twin ovulation and tubal lesions.

Cystic Ovaries

If one accepts that an ovarian cyst is an abnormally large and persistent follicle or a degenerate fluid-containing corpus luteum, then cystic ovaries scarcely occur in mares. Certainly nothing has been found to compare with the large multicystic ovary of cattle associated with nymphomania or with the luteinised cyst of the same species. It seems possible in the mare that the same follicles may persist for an abnormal length of time without undergoing their final maturation increase but it is questionable whether they should be called cysts. In view of the prolific follicle development which is such a feature of the mare it is quite possible that whatever the clinical signs of reproductive dysfunction, follicles of varying size and number will be present in the ovaries, and, as Aitken (1926) has remarked, the larger ones are often mistaken for cysts. But the study of infertility in the mare is only confused if structures, which in most mares are regarded as normal follicles are, in cases of reproductive dysfunction, referred to as "cysts." In other words it is illogical to treat such clinical dysfunctions by reference to the ovary alone. More appropriately, as Day (1939) has observed, they should be considered as the outcome of dysfunctions of the

endocrine glands which control reproductive activity and of environmental factors including season and nutrition.

Twin Ovulation

There is a wide discrepancy between the incidence of twin ovulation observed in this study and the percentage of twin births recorded by other workers. Thus the average extent of twin ovulation for the whole year in this series was 18.5 per cent., with a range of 5 to 37.5 per cent., whereas the percentage of equine twin births has been recorded as 1.5 (Uppenborn, 1933), 1.63 (Wagner, 1934), 1.23 (Mauch, 1937) and 1.1 (Craft, 1938). These conflicting figures suggest that there is in the mare a substantial loss of eggs or embryos after twin ovulation. Hancock (1948) records an actual twin conception rate of 20.8 per cent. in mares examined between the 45th and 70th day of pregnancy and he found that 3 out of 5 twin gestations were terminated by resorption before the 70th day. Also in the present work, of 3 uteri of early pregnancy 1 contained twin embryos while in the other 2, in addition to a single embryo in each, there were fragments of tissue which indicated that resorption of a second embryo had recently occurred. There is substantial additional evidence of early equine embryonic mortality from biological pregnancy tests (Barulin & Burcenko, 1935; Cole & Hart, 1942; Andrews & McKenzie, 1941): but Hancock (*loc. cit.*) has recorded a greater likelihood of early termination of gestation in mares pregnant with twins than in those carrying singles. If this latter fact is combined with the high overall incidence of twin ovulation seen in the present study, then it may be that herein lies an explanation for one type of temporary infertility in the mare.

The greater tendency for mares carrying twins, rather than singles, to abort between the 46th and 74th days may be due, according to Rowlands (1949), to a double set of endometrial cups and to a resultant higher concentration of gonadotrophin in the blood serum. The twin pregnancies which are sustained may be those in which both foetuses occupy one horn, in which case only one set of endometrial cups develops with a consequent lower level of serum gonadotrophin.

The hazard to horse breeding of double ovulation in relation to the birth, or abortion, of twin foals has been emphasised by Burkhardt (1948), and he recorded an incidence of 27 per cent. of double ovulation in mares slaughtered in June and July. He believed, however, that it was a phenomenon of the late breeding season and that there was small danger of twin pregnancies to services before late April or early May. On the contrary, the present study shows that twin ovulation, and presumably twin conception, can occur throughout the year and that its extent roughly parallels the degree of ovarian activity (Fig. 6). Breeding early in the year will avoid it only in the sense that there are less mares available for service at that time.

In passing, it may be mentioned that no support is forthcoming from this study for the assertion of Williams (1939) that "as an overwhelming rule equine twin pregnancies follow genital disease."

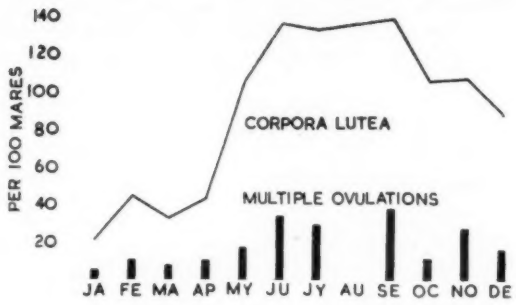

FIG 6.—SEASONAL OVARIAN ACTIVITY 1949-1951.

Tubal Lesions

Tubal occlusion is a rare cause of infertility in mares and attempts to improve the patency of the Fallopian tubes by the insufflation of gas are useless and dangerous.

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Current Literature

ABSTRACTS

Isolation of *Vibrio fetus* from Bulls. PLASTRIDGE, W. N., *et al.* (1957). *Amer. J. Vet. Res.* **18.** 575.

Cultural methods appear to offer the best means of detecting *Vibrio fetus* infection in bulls, but the presence of saprophytic bacteria in aseptically drawn semen and in preputial washings makes isolation of *V. fetus* by primary culturing in fluid mediums difficult and often impossible. Solid media fail to support the growth of some strains of *V. fetus* under the usual method of incubation in an atmosphere of 10 per cent. carbon dioxide and 90 per cent. air. This paper presents the results obtained by the use of an improved cultural procedure. Details of the method, which comprised streaking a loopful of semen and a loopful of thiol medium over the surface of a fresh blood agar plate, are given. Preputial samples were cultured in a similar manner both before and after centrifugation at 1,000 g. for 20 minutes. The majority of the plates were incubated at 37° C. for 3 days in bell jars. These were evacuated to 25 per cent. of atmospheric pressure and 10 per cent. carbon dioxide, and 65 per cent. nitrogen were then added. Following incubation small, translucent, light grey colonies were transferred to thiol medium. Up to 15 colonies were subcultured from the plates, depending upon the number available. The following results were obtained on 149 bulls in 4 artificial insemination centres:—

1. The incidence of carrier bulls was 41 per cent.

2. The number of tests on semen required to detect *V. fetus* in 61 bulls is given. The percentage of carrier bulls found positive on the first test was 39 per cent., on 2 tests 67 per cent., and on 3 tests 95 per cent. The results indicate that for practical purposes 3 tests are necessary before concluding that a bull is free from *V. fetus*.

3. In repeated tests on 57 carrier bulls, 54 per cent. of 263 semen samples yielded *V. fetus*. The ratio of positive to total samples varied for individual bulls. For example, 2 bulls were positive on one of 6 tests and 2 bulls were positive on 6 of 6 tests.

4. Of a total of 544 semen samples from 149 bulls, 27 per cent. yielded *V. fetus*, 3 per cent. catalase-negative vibrios, 59 per cent. were negative for *V. fetus*, and 11 per cent. contained saprophytic bacteria, either "spreading" colony producers or excessive numbers, that prevented a satisfactory test.

5. The number of colonies per semen sample that resembled those of *V. fetus* varied from 1 to 15. The proportion of such colonies that were identified as *V. fetus* averaged one of three, and ranged from one of 13 to 8 of 8. The estimated number of *V. fetus* organisms present in semen from which the organism was isolated averaged 800, and ranged from 100 to 9,000 per ml. Negative tests obtained on bulls which were positive on one or more tests indicate that the number of *V. fetus* organisms present in the semen of carrier bulls is frequently less than 100 per ml.

6. Seven of 18 preputial samples from 12 carrier bulls were positive. Centrifugation of preputial washings at 1,000 g. for 20 minutes and culturing the supernatant fluid increased the chances of isolating *V. fetus*.

7. Serological tests made on antigens of 110 cultures of *V. fetus* showed that 51 belonged to type 1 (the most common type found in cattle), 4 to type 2, one was spontaneously agglutinable, and 54 were inagglutinable by the antiserums used. None of the antigens of 11 catalase-negative vibrios were agglutinated by the *V. fetus* antisera.

J. O. L. K.

Congenital Loco in Turkeys. COLE, R. K. (1957). *Journal of Heredity*. **48.** 173-5.

The author describes an inherited lethal condition in a strain of white turkeys. The heterozygous birds (carriers) appeared normal, but homozygous poults were unable to support the head, which was held resting on the back or with the beak touching the floor. Noise or vibration caused them to lose their balance, which they regained with difficulty. Affected poults invariably died within a week. It was possible to eliminate the defect from the flock in one season by test mating with known heterozygous birds.

E. A. G.

REPORT

Diseases of Sheep—Ministry of Agriculture Publication No. 170.

The publications on diseases of sheep, both lay and professional, have been so numerous recently, that one wonders whether the ground has not been adequately covered. However, the author of this publication, Mr. W. T. Rowlands, has approached his subject in a novel and interesting manner, dealing with the commoner diseases, not in their usual classification, but under seasonal headings. He has grouped them according to whether they occur, or whether preventive measures should be taken against them, in spring, summer, autumn, or winter. This makes for easier reference and relates disease control more easily to the normal routine of sheep husbandry.

The booklet is intended for the shepherd, or for the flockmaster, and technical terms have been reduced to the minimum. Nevertheless, there is much in it of interest to the veterinary surgeon or the veterinary student.

There is, inevitably, in a book of this size, a tendency to over-simplify, but the main essentials are adequately covered, and it is pleasing to note that stress is laid on prevention and good husbandry rather than on treatment, while the necessity for accurate veterinary diagnosis is particularly advocated.

The booklet is well set up, but it would have been an advantage had larger type been used.

* See Erratum - v. 71 - p. 194 "vol. 18."

XUM

New Members of the R.C.V.S.

The following ladies and gentlemen were admitted to membership of the Royal College on the dates indicated:—

Alderson, Valerie Ann (Miss), 27, Hillfoot Avenue, Speke, Liverpool, 24, July 4th, 1958, B.V.SC. (LIV.); Ali, Mohammad Jaffer, B.V.SC. (PUNJAB), 6, Oakley Square, London, N.W.1, July 1st, 1958, London; Allan, William Hendry, 5, Morven Road, Bearsden, Glasgow, July 5th, 1958, B.V.M.S. (GLAS.); Allen, John Rodney, Bay Cottage, Dittisham, Dartmouth, S. Devon, June 21st, 1958, M.A., VET.M.B. (CANTAB.); Allsop, Margaret Anne (Miss), 155, High Lane Central, West Hallam, Derbyshire, July 5th, 1958, B.V.M.S. (GLAS.); Angelo, Sylvian Joseph, B.V.SC. (AGRA), c/o Major I. C. Webbe, Baraut, Distt. Meerut, U.P., India, July 1st, 1958, London; Archbold, William Alexander Carson, Hillview, Carnmoney, Co. Antrim, July 16th, 1958, B.V.M.S. (EDIN.); Banks, Donald Robert Butler, Woodland Cottage, Sandy Lane, Northwood, Middx., June 21st, 1958, B.A., VET.M.B. (CANTAB.); Batt, Roy Arthur Leonard, 11, Elgar Close, Elstree, Herts., July 4th, 1958, B.V.SC. (LIV.); Beadle, Grenville George, 28, Regent Road, Gt. Crosby, Liverpool, 23, July 4th, 1958, B.V.SC. (LIV.); Bedford, John Michael, 7, Park Gates Drive, Cheadle Hulme, Cheshire, June 21st, 1958, B.A., VET.M.B. (CANTAB.); Bhatia, Tej Raj Sing, B.V.SC. (AGRA), c/o Amar Singh, Technical Manager, Mawana Sugar Works, Mawana, Distt. Meerut, U.P., India, July 1st, 1958, London; Botcherby, William Clifton, 8, Weston Terrace, West Kilbride, Ayrshire, July 5th, 1958, B.V.M.S. (GLAS.); Bower, Edward Allan, St. Catherine's College, Cambridge, June 21st, 1958, B.A., VET.M.B. (CANTAB.); Bowie, John McHarg, B.SC. (AGRIC.), Withenfield, Bardowie, Milngavie, Glasgow, July 5th, 1958, B.V.M.S. (GLAS.); Brown, Charles George Duncan, Wellcome Research Laboratory, P.O. Kabete, Kenya, July 16th, 1958, B.V.M.S. (EDIN.); Bryan, Neil Michael, 21, Frankwell, Shrewsbury, July 4th, 1958, B.V.SC. (LIV.); Carrigan, Thomas Donald, 14, Carmunnock Road, Glasgow, S.4, July 1st, 1958, Glasgow; Clark, William Towler, 5, Park Crescent, Maud, Aberdeenshire, July 16th, 1958, B.V.M.S. (EDIN.); Collins, George Henry, 53, Upper Cranbrook Road, Redland, Bristol, 6, July 2nd, 1958, B.V.SC. (BRIS); Cook, Brian, 137, Salisbury Road, Totton, Southampton, Hants., July 2nd, 1958, B.V.SC. (BRIS.); Cornwell, Harold John Campbell, 27, Calverley Road, Stoneleigh, Epsom, Surrey, July 15th, 1958, B.V.M.S. (GLAS.); Cousins, Fergus Gerald Oliver, 135, Leinster Road, Rathmines, Dublin, July 5th, 1958, Dublin; Craigie, Elisabeth Cynthia (Miss), Mull Schoolhouse, Drummore, Stranraer, Wigtownshire, July 16th, 1958, B.V.M.S. (EDIN.); Cumming, Gilmour Thomas, Dreva, Victoria Road, Lundin Links, Fife, July 5th, 1958, B.V.M.S. (GLAS.).

Davies, Arthur, Bryn Tirion Farm, Bwlchgwyn, Nr. Wrexham, Denbighshire, July 4th, 1958, B.V.SC. (LIV.); Dewdney, Janet Margaret (Miss), 3, Mitten Road, Bexhill-on-Sea, Sussex, July 2nd, 1958, B.V.SC. (BRIS.); Dodson, Graeme Russell, 10, Cornwall Street, Edinburgh, 3, June 30th, 1958, Edinburgh; Duffy, Edward Francis, Killianiker House, Dromod, Co. Leitrim, Eire, July 5th, 1958, Dublin; Edwards, John, 43, Osmaston Road, Prenton, Birkenhead, Cheshire, July 4th, 1958, B.V.SC. (LIV.); Evans, David Lynn, 169, Graig Road, Godrwgraig, Swansea, Glam., July 2nd, 1958, B.V.SC. (BRIS.); Fletcher, Marguerite Ecroyd (Miss), 442, Rochdale Road, Middleton, Lancs, July 5th, 1958, B.V.M.S. (GLAS.); Francis, Philip George, Faulkland House, Faulkland, Nr. Bath, Somerset, July 4th, 1958, B.V.SC. (LIV.); Fraser, Daniel McKenzie, 24, Cranford Terrace, Aberdeen, July 16th, 1958, B.V.M.S. (EDIN.); Gaffney, William Michael Noel, Lismacaffrey, Mullingar, Co. Westmeath, Eire, July 5th, 1958, Dublin; Gale, Robert Malcolm, 191, Dryden Road, Gateshead, 9, Co. Durham, July 2nd, 1958, B.V.SC. (BRIS); Gormley, Brian Anthony, Pulladoey, Aughnacliffe, Longford, Eire, July 5th, 1958, Dublin; Gray, Arthur Ross, Banesley Lane Farm, Ravensworth, Gateshead, 11, Co. Durham, July 21st, 1958, B.A., VET.M.B. (CANTAB.); Grigor, John Alasdair, P.O. Box 240, Nanyuki, Kenya, July 16th, 1958, B.V.M.S. (EDIN.); Halnan, Clive Robert Edward, 55, Park Lane, Carshalton, Surrey, June 21st, 1958, B.A., VET.M.B. (CANTAB.); Hamilton, Arthur Francis, 1, Hillfoot Avenue, Bearsden, Glasgow, July 5th, 1958, B.V.M.S. (GLAS.); Harper, David Gordon, 27, High Storrs Crescent, Sheffield, 11, Yorks, June 21st, 1958, B.A., VET.M.B. (CANTAB.); Harrington, Donald Patrick, Chestnut Lodge, Birr, Offaly, Eire, July 5th, 1958, Dublin; Harrison, Thomas Cherrie, 6, Ashlea Drive, Giffnock, by Glasgow, July 1st, 1958, Glasgow; Hervey, Yvette Irma (Miss), 13, Temple Farm Park, Sandford-on-Thames, Oxford, July 1st, 1958, Cambridge; Heywood, Ralph, Ingledene, Shepley, Nr. Huddersfield, Yorks., July 16th, 1958, B.V.M.S. (EDIN.); Hiddleston, William Alexander, Cargenholm, Dumfries, July 5th, 1958, B.V.M.S. (GLAS.); Hothersall, Maureen (Miss), 40, Claremont Road, Accrington, Lancs., July 4th, 1958, B.V.S.C. (LIV.); Hudson, Geoffrey Brian, 444, Acklam Road, Acklam, Middlesbrough, Yorks., July 16th, 1958, B.V.M.S. (EDIN.); Hughes, William Arthur, 53, Alliance Way, Stoke Heath, Coventry, Warwicks., July 2nd, 1958, B.V.SC. (BRIS.); Hussain, Iftikhar, B.V.SC. (PUNJAB.), 18, Rochester Terrace, London, N.W.1, July 1st, 1958, London.

Ingman, Neville Rendall, 25, Ael y Bryn, Garden Village, Wrexham, Denbighshire, July 4th, 1958, B.V.SC. (LIV.); Jackson, Jane Marie Theresa (Miss), Ackenthwaite House, Milnthorpe, Westmorland, July 16th, 1958, B.V.M.S. (EDIN.); James-Ashburner, Paul Wilson, 53, Sneyd Avenue, Newcastle, Staffs., July 2nd, 1958, B.V.SC. (BRIS.); Janes, Peter Desmond, 89, Westbrook Road, Shirley, Solihull, Warwicks., July 4th, 1958, B.V.SC. (LIV.); Juby, Walter David, Grove Farm, Mendlesham Green, Stowmarket, Suffolk, July 2nd, 1958, B.V.SC. (BRIS.); Kelleher, Daniel Lauri, Ardeevin, Bantry, Co. Cork, Eire, July 5th, 1958, Dublin; Kennedy, Andrew Stewart, 94, Drumlanrig Street, Thornhill, Dumfriesshire, July 16th, 1958, B.V.M.S. (EDIN.); Kennedy, Gilbert John, Academy House, Beith, Ayrshire, July 5th, 1958, B.V.M.S. (GLAS.); Kenny Michael Patrick, Killosser, Swinford, Co. Mayo, Eire, July 5th, 1958, Dublin; Kinch, David Alan, The Kennels, Canongate, Alnwick, Northumberland, July 16th, 1958, B.V.M.S. (EDIN.); Leek, Barry Frank, 66, Watford Road, King's Norton, Birmingham, 30, July 16th, 1958, B.V.M.S. (EDIN.); Leslie, Norman William, 34, Eglinton Road, Donnybrook, Dublin, July 5th, 1958, Dublin; Lingwood, Michael Bryan, 6, Marlowe Road, Newnham, Cambridge, June 21st, 1958, B.A., VET.M.B. (CANTAB.); Lloyd, Anne Shirley (Miss), Innisfree, Liverpool Road, Buckley, Flints., July 4th, 1958, B.V.SC. (LIV.); Lloyd, Richard, Taylors Croft, Batley Road, Kirkhamgate, Nr. Wakefield, Yorks., July 4th, 1958, B.V.SC. (LIV.); Llywelyn, Gwynn, 10, Judges Drive, Liverpool, 6, July 4th, 1958, B.V.SC. (LIV.); Lyons, Valentine, Blackcastle, Navan, Co. Meath, Eire, July 5th, 1958, Dublin; Macarthur, Gordon John, Brooklands Cottage, Massams Lane, Formby, Lancs., July 4th, 1958, B.V.SC. (LIV.); McCabe, David Watson McDonald, 24, Kincardine, Crieff, Perthshire, July 16th, 1958, B.V.M.S. (EDIN.); McCracken, John Aitken, 92, Overdale Street, Langside, Glasgow, S.2, July 5th, 1958, B.V.M.S. (GLAS.); McGuigan, David, 41, Whitletts Road, Ayr, July 5th, 1958, B.V.M.S. (GLAS.); Macintyre, Colin David, 4, Matilda Road, Glasgow, S.1, July 5th, 1958, B.V.M.S. (GLAS.); MacKenzie, Peter Kenneth Ian, P.O. Trelawney, S. Rhodesia, July 16th, 1958, B.V.M.S. (EDIN.); McKinley, Patrick Joseph, 72, Castle Street, Ballycastle, Co. Antrim, July 5th, 1958, Dublin; Mackintosh, James Alexander, 19, Ardconnel Terrace, Inverness, July 5th, 1958 B.V.M.S. (GLAS.); Macnab, Peter Jeffrey, Ryeloch, Albert Road, Dumfries, July 16th, 1958, B.V.M.S. (EDIN.); MacVicar, Malcolm John, Claddach Kirkibost, Lochmaddy, North Uist, Inverness-shire, July 5th, 1958, B.V.M.S. (GLAS.); Maasry, Khalil Jirji, B.A. (BEIRUT), Aley, Lebanon, June 30th, 1958, Edinburgh; May, Jeremy Nigel Tinslay, The Old Farm Cottage, Haling Grove, S. Croydon, Surrey, July 1st, 1958, London; Meadows, Graham William, 35, Westbury Road, Henleaze, Bristol, July 2nd, 1958, B.V.SC. (BRIS.); Mears, Hazel (Miss), 91, Leonard Street, Derby, July 4th, 1958, B.V.SC. (LIV.); Mitchell, Benjamin, Whitecairns, New Deer, Aberdeenshire, July 16th, 1958, B.V.M.S. (EDIN.); Moloney, James Brendan, Ballymacjordan, Abbeyfeale, Co.

Limerick, Eire, July 5th, 1958, Dublin; Morgan, Elizabeth (Miss), 8, Cairn View, Aidrie, Lanarks, July 5th, 1958, B.V.M.S. (GLAS.); Mott, Brian, 42, Cotham Vale, Cotham, Bristol, 6, July 2nd, 1958, B.V.SC., (BRIS.); Moyes, Isabella Whyte (Miss), Balruddery, Wellesley Road, Methil, Fife, July 5th, 1958, B.V.M.S. (GLAS.); Murray-Hayden, Peter Julian, 16, Wellington Road, Ballsbridge, Dublin, July 5th, 1958, Dublin.

Needham, Ernest James, Station House, Thurstaston, Heswall, Wirral Cheshire, July 16th, 1958, B.V.M.S. (EDIN.); Noddle, Barbara Alice (Miss), 36, Old Sneed Avenue, Bristol, 9, June 21st, 1958, B.A., VET.M.B. (CANTAB.); Nutt, Peter, 204, Manchester Road, Mossley, Nr. Manchester, July 16th, 1958, B.V.M.S. (EDIN.); O'Brien, Patrick, Ballyneety, Pallasgreen, Co. Limerick, Eire, July 5th, 1958, Dublin; O'Connell, John, Knockane, Mallow, Co. Cork, Eire, July 5th, 1958, Dublin; O'Donnell, Liam Ignatius, 12, Dunseverick Road, Clontarf, Dublin, July 5th, 1958, Dublin; O'Neill, Alexander, 3, Neptune Terrace, Bottystown, Co. Meath, Eire, July 5th, 1958, Dublin; O'Neill, Conal Patrick, Cappamore, Co. Limerick, Eire, July 5th, 1958, Dublin; Paton, John Ewan, 30, Fisher Street, Stranraer, Wigtownshire, July 5th, 1958, B.V.M.S. (GLAS.); Parry, John Alderson, Crosswood, Brecon, S. Wales, June 21st, 1958, B.A., VET.M.B. (CANTAB.); Pearson, Patrick David, Brierlea, Stream Road, Kingswinford, Staffs, July 4th, 1958, B.V.SC. (LIV.); Perry, Kenneth Thomas Edwin, 15, Cressington Avenue, Birkenhead, Cheshire, July 4th, 1958, B.V.SC. (LIV.); Pirie, Hugh Munro, 116a, Main Street, Coatbridge, Lanarks., July 5th, 1958, B.V.M.S. (GLAS.); Plenderleith, Warnock Rodger, Annieslea, Thankerton, Biggar, Lanarks, July 5th, 1958, B.V.M.S. (GLAS.); Prendergast, Michael Joseph Gerard, Central Hotel, Claremorris, Co. Mayo, Eire, July 5th, 1958, Dublin; Proctor, Garth Michael, 197, Pringle Street, Blackburn, Lancs., July 4th, 1958, B.V.SC. (LIV.); Quill, Timothy Stephen, Example Farm, Blarney, Co. Cork, Eire, July 5th, 1958, Dublin; Reed, Julian Robin, Sheldon Court, Sheldon, Honiton, Devon, July 2nd, 1958, B.V.SC. (BRIS.); Reid, Ptolemy Alexander, D.V.M. (TUSKEGEE), Betsy Ground, Canje, Berbice, British Guiana, July 1st, 1958, London; Rendall, Graham Francis, 16, Grove Road East, Christchurch, Hants, July 2nd, 1958, B.V.SC. (BRIS.); Rennie, Lessel John Charles, Wester Fintray, Kintore, Aberdeenshire, July 16th, 1958, B.V.M.S. (EDIN.); Roberts, Clive Frederick, The Close, Thornbury, Glos., July 2nd 1958, B.V.SC. (BRIS.); Rogers, Elizabeth Marion (Miss), 25, Rankeillor Street, Edinburgh, 8, July 16th, 1958, B.V.M.S. (EDIN.).

Sapte, Sheila Autoinette (Miss), 63, The Avenue, Watford, Herts., June 21st, 1958, B.A., VET.M.B. (CANTAB.); Schlesinger, Percy Julius, 6, Harcourt Terrace, Dublin, July 5th, 1958, Dublin; Seneviratna, Kodikara Arachchige Daniel Peter Sirisena, PH.D. (EDIN.), B.V.SC. (MADRAS), Dept. of Pathology, University of Ceylon, Peradeniya, Ceylon, July 1st, 1958, London; Sharpe, Heather Belle Angela (Miss), Farway, Codsall, Nr. Wolverhampton, Staffs., July 2nd, 1958, B.V.SC. (BRIS.); Sheahan, Thomas Joseph, 14, William Street, Listowel, Co. Kerry, Eire, July 5th, 1958, Dublin; Smellie, Margaret Carrick Pinkerton (Miss), Baron Cliff, Cove, by Helensburgh, Dunbarton, July 5th, 1958, B.V.M.S. (GLAS.); Smith, Francis Michael, Liss, Oldcastle, Co. Meath, Eire, July 5th, 1958, Dublin; Smith, Michael Seward, 1, Stoke Manor, Stoke, Nr. Nantwich, Cheshire, July 2nd, 1958, B.V.SC. (BRIS.); Smyth, John James, Killyflue, Ballymena, Co. Antrim, July 5th, 1958, Dublin; Smyth, Julian Michael, 41, Elm Tree Road, St. John's Wood, London, N.W.8, June 21st, 1958, M.A., VET.M.B. (CANTAB.); Sulley, Michael John, 95, Lubenham Hill, Market Harborough, Leics., July 4th, 1958, B.V.SC. (LIV.); Taylor, Betsy Rae (Miss), Craigmore Pier, Rothesay, Bute, July 16th, 1958, B.V.M.S. (EDIN.); Taylor, Michael Claude, Ellerslie, Nottingham Road, Long Eaton, Nottingham, July 5th, 1958, B.V.M.S. (GLAS.); Thomson, James Whitehead, 32, Strand Street, Gwelo, S. Rhodesia, July 16th, 1958, B.V.M.S. (EDIN.); Thurgur, John Reginald, 117, Ruskin Avenue, Lincoln, July 5th, 1958, B.V.M.S. (GLAS.); Tripathy, Gulab Dutt, B.V.SC. (AGRA.), c/o 53a, Camden Square, London, N.W.1, July 1st, 1958, London; Waterworth, James, Stoneacre, Dalton, Appley Bridge, Wigan, Lancs., July 4th, 1958, B.V.SC. (LIV.); Watson, Moira Renata Mounier (Miss), 11, Annfield Place, Glasgow, E.1, July 5th, 1958, B.V.M.S. (GLAS.); Webster, Michael Crossley, Hawson Court, Buckfastleigh West, S. Devon, July 5th, 1958, B.V.M.S. (GLAS.); Wells, Alexander Charles James, Cedar Bank, Watcombe Heights, Torquay, Devon, June 21st, 1958, B.A., VET.M.B. (CANTAB.); White, Roy Owen, Sunnimeade, Chester Road, Woodford, Cheshire, July 16th, 1958, B.V.M.S. (EDIN.); Wilson, William Douglas, Grange Cottages, St. Andrews, Fife, July 5th, 1958, B.V.M.S. (GLAS.); Winkler, Carl Edward, Bwlchheble, Llan-y-Creuddyn, Nr. Aberystwyth, Cards., July 2nd, 1958, B.V.SC. (BRIS.); and Wright, Iain George Anderson, Tanteen, St. Georges, Grenada, West Indies, July 16th, 1958, B.V.M.S. (EDIN.).

News and Comment

MR. THOMAS ROGER THOMAS

Professor McCunn writes:—

"Tommy" Thomas died in the early hours of Monday, August 4th, following a heart attack. He had practised in Carmarthen for almost 40 years. Shortly after graduating in 1919 he put up his plate in his native place, the Carmarthen area. To put up a plate and start from scratch needed a lot of courage and faith in those days when even the old-established practices were not very prosperous. By dint of hard work and the giving of service this modest, courteous, quiet-spoken, and kindly man laid the foundations of what was to become one of the largest practices in South Wales.

When he joined the Royal Veterinary College as a student he was considerably older than his class fellows and in consequence learning new procedures did not come easily to him. He made up for this by hard work. After he had been at the College for some time it was discerned that his preliminary education examination did not fulfil the rigid requirements of the R.C.V.S. for at that time all the prescribed subjects had to be passed at one and the same time. He again studied for this examination and passed it, but his entry as a veterinary student was delayed so that it dated from January instead of October. This made him into a "Christmas" student and he was always six months behind his original contemporaries.

Hard work, conscientious service, and courtesy soon had its effects upon his practice and it was necessary for him to move to a more central position in Carmarthen town. He was disturbed by the losses occasioned by tuberculosis in cattle, not only by deaths but in other ways. He told me in June of this year that the farmers accepted these losses as inevitable. He managed to persuade some of them to use the test, the subcutaneous one, and cull reactors. This policy paid dividends not only to the farmer but to Thomas himself for the benefits accruing from freedom from tuberculosis were not lost on the provident Welshman.

South Wales will always hold honour for being one of the places in which the idea for the eradication of tuberculosis was born, and Thomas the pioneer must be honoured for his foresight and also for the way

in which he was able to get stock-owners to accept the proposition.

Thomas was never one to seek the limelight, he only took a mild interest in veterinary politics, being quite content to devote all his time and energy to his work. He was full of commonsense and could exercise good judgment—two of the most important attributes of a competent veterinary surgeon. He was a good horsemaster and horseman and almost up to the end he would mount and test any animal submitted to him for examination. I am glad that I was able to spend a day in June with my old friend and I will cherish the memory of that beautiful day in his company.

The sympathy of the profession goes out to Mrs. Thomas, his helpmate over all the years, and to his son John.

R.C.V.S. OBITUARY

We record with regret the death of the following member of the profession:—

TWADDLE, Edward Flower, Assistant Chief Veterinary Officer, Department of Agriculture, Fremantle, Western Australia, Major A.A.V.C. (Retd.). Graduated July 21st, 1922, at the Veterinary College of Ireland, Dublin. Died July 31st, 1958, aged 57 years.

MR. E. F. TWADDLE

Mr. J. Craig, Senior Veterinary Officer, Department of Agriculture, Perth, writes:—

Mr. Twaddle first arrived in Australia in 1927, joining the Western Australian Department of Agriculture in 1928. For many years he acted as animal quarantine officer at Fremantle where he supervised the import and export of animals and animal products.

Prior to 1939 he acted as veterinary officer with the 10th Australian Light Horse. During World War II he served with the A.A.V.C. as O.C., 5th Australian Veterinary Hospital, 2nd A.I.F., holding the rank of major.

Mr. Twaddle was held in high esteem by his veterinary colleagues and by all others with whom he came into contact. His manner was gentle and sincere. His personal conduct was of a very high order and the conscientious manner with which he carried out his veterinary duties was a byword.

He is survived by his widow and three children.

POISON HAZARDS FROM AGRICULTURAL SPRAYS

The extensive use of sprays for the control of pests, now unusually prevalent on account of the wet season, has again raised the question of hazards to livestock resulting from lack of care in the application of such sprays.

It appears that special note should be taken of the risks attendant on the use of copper-containing sprays for potato blight and arsenical preparations for killing potato haulms or weeds. The advice given by official sources, and supplied by manufacturers, should be carefully followed. In particular it is essential (1) that access of stock to treated fields is prevented, (2) that spray drift and spillage do not contaminate fields other than those treated, and (3) that food and water for domestic animals and birds near spraying operations are protected from contamination.

50 YEARS AGO

Abstract of Address by Professor J. Penberthy, F.R.C.V.S., President of the Veterinary Conference

The set subject arranged by the Council of the Institute for discussion in this Section is "Meat and Milk in Relation to Animal Tuberculosis." To those whose work entails the constant consideration of these matters it might appear that the subject has been laboured *ad nauseam*, but second thought will convince us that, even so, finality has not been arrived at. Many points concerning the relations of meat and milk to animal tuberculosis have, we believe, been definitely settled. The ground is clearer for action to-day than before, but "times change and we change with them." It has been truly said that the belief of one age may be the heresy of the next. A careful study of the views expressed by those whose position entitles their opinion to our respect will indicate that our subject is no exception. I take it, too, that one of the principal objects of this and similar gatherings is the education of public opinion, a task demanding the greatest delicacy and force, and scientific accuracy. To effect our purpose it is essential that in our deliberations we realise the absolute necessity for statements of fact, well-conceived deliberate deductions, and practical suggestions. . . .

Our experience of meat inspection will, I think, allow of the conclusion that where this is carried out uniformly and systematically by officers having an intimate knowledge of animal diseases and pathological processes, and actuated by sound common sense, the public is amply safeguarded against the risk of contracting tuberculosis from consumption of home-killed animal flesh, and the trader has little to complain of from unjustifiable seizure. It must, however, be insisted on that such highly important and responsible duties as the inspection of meat should be exercised only by those who possess the requisite knowledge. The special education of the veterinary surgeon in the laws affecting the health of the domesticated animals, in anatomical, physiological, and morbid states of their tissues, and pathological processes affecting them, brings within his view the consideration of the conditions under which tubercle bacilli may contaminate flesh used as food of man. In this consideration he will be guided by realisation of the fact that before flesh may be regarded as infective it must be infected. . . .

With the knowledge gained as to methods of inspection and the amount of animal flesh condemned as unfit for human consumption by public authorities sufficiently enlightened to adopt measures at their disposal, it is nothing short of a national disgrace that a large proportion of animal flesh offered for sale is not subjected to inspection, and that there is in the greater part of the kingdom no check on the traffic in diseased meat and cattle. On behalf of the unprotected portion of the community we make this demand for general and uniform inspection.

PERSONAL

Dr. L. F. L. Clegg, National Institute for Research in Dairying, has been appointed Professor of Dairying in the University of Alberta. As joint editor of *The Journal of Applied Bacteriology*, with Dr. S. E. Jacobs, Imperial College of Science and Technology, he will be succeeded by Dr. C. A. E. Briggs, PH.D., M.R.C.V.S., of the N.I.R.D. Dr. Briggs recently attended the VIIth International Congress for Microbiology in Stockholm.

Births

BHASKER.—On July 10th, 1958, at the Women and Children Hospital, Madras, to Premavathi, wife of C. G. Bhasker, B.V.SC., M.R.C.V.S., a son, Srinivasan.

COUTTS.—On August 9th, to Dorothy, wife of Kenneth Coutts, B.SC., M.R.C.V.S., of 102, Coventry Road, Nuneaton, Warwickshire, a son.

STARTUP.—On August 4th, 1958, to Christine and Geoffrey Startup, MS.R.C.V.S., of Worthing, a son, Nicholas, brother for Richard and Michael.

WHITELEY.—On August 9th, at the Westwood Hospital, Beverley, to Ann, wife of Hedley Whiteley, B.V.SC., M.R.C.V.S., a son, Andrew Paul.

Engagement

MASON—EVEMY.—Roger S. Mason, B.V.SC., M.R.C.V.S., of Lower Hayne, Corfe, Taunton, Somerset (now in Kenya), to Miss Shirley Evemy of 40, North Street, Taunton, Somerset (now in Cape Town).

Marriage

GOODWIN—SMITH.—On July 26th, 1958, at St. Mary's Church, Eling, Hants., Peter John Goodwin, B.V.SC., M.R.C.V.S., of Hythe, Hants, to Gillian (Bundle) Smith of Heunsdown, Hants.

COMING EVENTS

September

3rd (Wed.). Meeting of the Southern Counties Veterinary Society at the Polygon Hotel, Southampton, 7.30 p.m.

General Meeting of the South Wales Division at the Golden Grove Farm Institute, Llandilo, 2 p.m.

17th (Wed.). Meeting of the North Wales Division at Glynllifon, Caernarvon.

21st to 26th (Official Opening, Monday, September 22nd). 76th Annual Congress of the British Veterinary Association in Douglas, Isle of Man.

23rd (Tues.). General Meeting and Dinner of the Royal (Dick) School of Veterinary Studies Alumnus Association at the Villiers Hotel, Douglas, I.o.M., 6 p.m.

October

4th (Sat.). R.A.V.C. Old Comrades' Association Annual Reunion and Dinner, Bridge House Hotel, London Bridge.

ADDRESSES OF DISEASE INFECTED PREMISES

The list given below indicates, first the county in which are situated the premises on which disease has been confirmed, followed by the postal address and date of outbreak.

Anthrax

Northants. Shotley Farm, Harringworth, Corby (Aug. 13); Mill Field, Harringworth, Corby (Aug. 15).

Foot-and-Mouth Disease

Kent. Grays Farm, Westerham Hill, Westerham (Aug. 14).

Fowl Pest

Ayr. Beolack and Glasgullock, Barr, Girvan (Aug. 15).

Cambs. Elliott Road, March (Aug. 8); 23, Wisbech Road, March (Aug. 13); 303, Norwood Road, March (Aug. 14); 106, Russell Avenue, March (Aug. 18).

Essex. Websters Premises, Rush Green, Clacton-on-Sea; 491, Ipswich Road, Colchester (Aug. 9); Mayo House, Crown Lane, Ardleigh, Colchester (Aug. 10); Glendenning Farm, Thorrington, Colchester (Aug. 12); Two Ways, Station Road, Thorrington, Colchester; Claremont, Butts Green, Sandon, Chelmsford (Aug. 14); Dumpling Hall, Clay Lane, St. Osyth, Clacton-on-Sea (Aug. 15); Frandon, Station Road, Thorrington, Colchester (Aug. 18).

Kent. 4, Powerscroft Road, Sidcup; Brook Farm, Sidcup (Aug. 12); Sarum, Southfield Road, West Kingsdown, Sevenoaks (Aug. 13).

Norfolk. Bracon Ash, Norwich; Home Farm, Westwick, Norwich (Aug. 9); The Gables, Mattushall, East Dereham; Dereham Road, Mattishall; Potash Farm, Banham, Norwich; Poppys Farm, Wevbread, Diss; Herne Farm, Beeston, King's Lynn (Aug. 11); 10, Bexfield Close, Foulsham; Manor House, Longhan (Aug. 12), Heath Road, Banham, Norwich (Aug. 13); Westgate Street, Hevingham, Norwich; West Carr Road, Attleborough (Aug. 14); The Folly, Hingham, Norwich (Aug. 15); Wood Farm, Starston, Harleston (Aug. 17); Glenshiel, West End, Old Costessey (Aug. 18).

Suffolk. Kendra, Beccles Road, Bradwell (Aug. 14); Uplands Farm, Kersey, Hadleigh (Aug. 16).

Yorks. Flying Horse Farm, Whinmoor, Leeds (Aug. 8).

Swine Fever

Beds. Witches Farm, A-6 Road, Sharnbrook (Aug. 8); Church Farm and Village Farm, Cockayne Hatley, Sandy (Aug. 18)

Berks. Formosa, Bearwood Road, Barkham (Aug. 11).

Bucks. Palmers Moor Poultry Farm, Iver (Aug. 11).

Caernarvon. Railway Hotel, Cwm-y-Glo (Aug. 8).

Cambs. Binnimoor Road, March (Aug. 13).

Dorset. Wayfields, East End, Corfe Mullen, Wimborne (Aug. 8); 5, Brixey Road, Parkstone, Poole (Aug. 12).

Essex. Grange Farm, Allotments, Whitehall Road, Old Heath, Colchester (Aug. 18).

Flints. Hendry Farm, Mold (Aug. 13); 27, Fairfield Road, Queensferry (Aug. 18).

Glam. Piggeries at Plots 149, 152, and 153, Ely River Bank Allotments, Cardiff (Aug. 14).

Hants. Silverlands, Silver Street, Hordle, Lymington (Aug. 18).

Lancs. Oldfield Carr Farm, Poulton-le-Fylde, Blackpool; The Piggeries, Boyswell Estate, Poolstock, Wigan (Aug. 11).

Leics. The Grange, Dingley, Market Harborough (Aug. 8).

Norfolk. Brick Kiln Farm, Shropham, Attleborough (Aug. 12).

Notts. Bassingfield Lane, Gamston, Retford (Aug. 18).

Suffolk. Box Tree Farm, Wattisham, Ipswich (Aug. 11); North Green Farm, Cratfield, Halesworth; Model Farm, High Town Green, Rattlesden, Bury St. Edmunds (Aug. 12); Allwood Green, Rickinghall Superior, Diss (Aug. 13); R.A.F. Station, Honington, Bury St. Edmunds (Aug. 18).

Surrey. Northorpe, Green Lane, Egham; Langley Vale Farm, Epsom (Aug. 15).

Warwicks. Holt Farm, Welsh Road, Southam, Leamington Spa (Aug. 11); Old Milverton Allotments, Leamington Spa (Aug. 18).

XUM

Letters to the Editor

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the B.V.A.

New Mileage Allowance for L.V.I.s

Sir,—There must be many members of the profession who, like myself, have been wondering how "ERNIE" is employed when he is not drawing winning numbers of premium bonds. The answer is provided by the publication of the Ministry memorandum on mileage allowances. The figures of 3¾d. and £14 10s. may have been arrived at by some method of mathematical calculation but there is no evidence of this and none is offered by the authors. It seems far more likely that somebody tickled "ERNIE" and out came the figures.

I wish to register my disgust at this arbitrary decision, arrived at without any consultation with those who will suffer considerable financial loss if its provisions are enforced. I hope that the R.C.V.S. and the B.V.A. will use all their influence to have this unjust decision reversed.

Yours faithfully,

HAROLD L. SMITH.

Manor House,
Rowde,
Devizes.

August 9th, 1958.

Castration by the Rubber Band Method

Sir,—It would appear from the literature that American veterinary surgeons have also encountered severe outbreaks of tetanus following castration by this method. A. A. Case, writing in *Sheep Breeder and Sheepman*, April, 1958, records that this condition caused much trouble on certain farms, and the instances reported this season were mainly associated with the use of rubber bands for docking and castrating.

The editor of the *J.A.V.M.A.* considered this article important enough to insert an abstract in his journal for June 15th, 1958.

Yours faithfully,

RICHARD H. C. PENNY.

The Black Lion Yard,
High Street,
Leighton Buzzard,
Beds.

August 8th, 1958.

The Vetinfile

Sir,—May I refer to your review of the Vetinfile, with which I have an editorial connexion, to point out that the allegation that no references are given, is what is politely expressed as a terminological inexactitude? With a few exceptions every item has its reference appended. Thus, a reader interested in the item from Iowa (mentioned by the reviewer) is referred to the *Journal of the American Veterinary Medical Association*, vol. 128, p. 583. The reference is given in condensed form, which would take a librarian perhaps 2 seconds to interpret. However, we believe that practitioners want facts and have very little interest in authors' names or journal citations.

As for your reviewer's opinion that practitioners know it all already anyway, your readers may, I suggest, be interested to have some opinions from among their own ranks.

Yours faithfully,

J. T. EDWARDS.

Harden Park,
Alderley Edge.

August 15th, 1958.

ADVERTISERS' ANNOUNCEMENTS

BURROUGHS WELLCOME & Co. announce the introduction of "Wellcome" brand Improved Lamb Dysentery Vaccine for the protection of new-born lambs, *via* the colostrum, against pulpy kidney disease and lamb dysentery.

The use of this new vaccine can be so adapted that the adult sheep themselves can be protected against pulpy kidney disease and "struck." The vaccine is given in a dose of 2 c.c. and is available in bottles of 100 c.c.

GLAXO LABORATORIES LTD. announce the introduction of Biotexin Cerate as from Monday, August 18th. Biotexin Cerate contains novobiocin in an oily base with 3 per cent. aluminium stearate, each tube delivering 0.25 grammes of novobiocin which is present as the monosdium salt. The product is available in a pack of 12 tubes.

Novobiocin has an antibacterial activity which can be compared with penicillin. Its principal value in mastitis is in the control of staphylococcal injections which are not susceptible to other antibiotics.

DISEASES OF ANIMALS ACT, 1950—GREAT BRITAIN
Summary of Returns of Confirmed Outbreaks of Scheduled (Notifiable) Diseases

Period		Anthrax	Atrophic Rhinitis	Foot-and-Mouth	Fowl Pest	Sheep Scab	Swine Fever
16th to 31st July, 1958		6	—	—	49	—	55
Corresponding period in	1957	6	1	9	21	—	38
	1956	26	—	—	34	—	50
	1955	11	1	—	27	—	60
1st January to 31st July, 1958		102	3	111	371	—	821
Corresponding period in	1957	242	6	37	516	—	568
	1956	1,063	8	13	388	—	471
	1955	472	2	6	371	—	964